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Substitute for form 1449/PTO

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| Application Number | 10/654,790 |
| Filing Date | 9/4/03 |
| First Named Inventor | Pan |
| Art Unit | 2818 |
| Examiner Name | M. Tran |
| Attorney Docket Number | |

Sheet 1 of 5

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| | 1 | J.L. PAN, J.E. McMANUS, L. GROBER and J.M. WOODWALL, Gallium-arsenide deep-level pin tunnel diode with very negative conductance, Electronics Letters, Sept. 18, 2003, Vol. 39 No. 19 | |
| | 2 | JANET L. PAN, JOSEPH E.MCMANIS, THOMAS OSADCHY, LOUISE GROBER, JERRY M. WOODALL and PETER J. KINDLMANN, Gallium arsenide deep-level optical emitter for fibre optics, Nature Materials, June 2003, pp. 375-378, © 2003 Nature Publishing Group | |
| | 3 | JANET L. PAN, J.E. McMANIS, L. GROBER, J.M. WOODALL, Gallium-arsenide deep-level tunnel diode with record negative conductance and record peak current density, Solid-State Electronics 48, (2004), pp. 2067-2070, © 2004 Elsevier Ltd. | |
| | 4 | JANET L. PAN, Analytical method for finding the general optical properties of semiconductor deep centers, Journal of Applied Physics, Nov. 15, 2002, pp. 5991-6004, Volume 92, Number 10, © 2002 American Institute of Physics | |
| | 5 | JANET L. PAN, Optical emission from bound states of semiconductor deep-centers, Optics Express, Dec. 17, 2001, pp. 796-801, Vol. 9, No. 13, © 2001 OSA | |
| | 6 | S. FUKUSHIMA, K. MUKAI, N. OTSUKA, X-ray diffraction analysis of LT-GaAs's multilayer structures, Journal of Crystal Growth, 2002, pp. 1-5, © 2002 Published by Elsevier Science B.V. | |
| | 7 | G. M. MARTIN, M. L. VERHEIJKE and J.A.J. JANSEN, Measurement of the chromium concentration in semi-insulating GaAs using optical absorption, J. Appl. Phys. 50(1), Jan. 1979, pp. 467-471, © 1979 American Institute of Physics | |
| | 8 | J. SERRANO, A. WYSMOLEK, T. RUF, M. CARDONA, Spin-orbit splitting of acceptor states in Si and C, Physica B. 273-641 (1999), pp. 640-643, © 1999 Elsevier Science B.V. | |
| | 9 | C.R. PIDGEON and R.N. BROWN, Interband Magneto-Absorption and Faraday Rotation in InSb, Physical Review, June 10, 1966, pp. 575-583, Volume 146, Number 2 | |
| | 10 | G. MARTINEZ, A.M. HENNEL W. SZUSZKIEWICA, and M. BALKANSKI, Charge transfer Cr ³⁺ (3d ³) Cr ²⁺ (3d ⁴) in chromium-doped GaAs, Physical Review B, April 15, 1981, pp. 3920-3932, Volume 23, Number 8, © 1981 American Physical Society | |

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| | 11 | PETER C. SERCEL, AL. L. EFROS and M. ROSEN, Intrinsic Gap States in Semiconductor Nanocrystals, Physical Review Letters, Sept. 20, 1999, pp. 2394-2397, Volume 83, Number 12, © 1999 The American Physical Society | |
| | 12 | D.T.J. HURLE, Charged native point defects in GaAs and other III-V compounds, Journal of Crystal Growth, pp. 1-7, 2002 Published by Elsevier Science B.V., © 2002 Published by Elsevier Science B.V. | |
| | 13 | J.C. BOURGOIN, H. HAMMADI, M. STELLMACHER, J. NAGLE, B. GRANDIDIER, D. STIEVENARD, J.P. NYS, C. DELERUE, M. LANNON, As antisite incorporation in epitaxial growth of GaAs, Physica B 273-274, 1999, pp. 725-728, © 1999 Elsevier Science B.V. | |
| | 14 | R. L. WEIHER and W.C. TAIT, Application of the Quantum-Defect Method to Optical Transitions Involving Deep Effective-Mass-Like Impurities in Semiconductors, Physical Review, Sept. 9, 1969, pp. 1116-1126, Volume 185, Number 3 | |
| | 15 | M. KAMINSKA, M. SKOWRONSKI, and W. KUSZKO, Identification of the .082-eV Electron Trap, EI 2 in GaAs, as an Isolated Antisite Arsenic Defect, Nov. 11, 1985, pp. 2204-2207, Volume 55, Number 20, © 1985 The American Physical Society | |
| | 16 | J. SERRANO, M. CARDONA, T. RUF, Spin-Orbit splitting in diamond: excitons and acceptor related states, Solid State Communications 113 (2000), pp. 411-414, © 2000 Elsevier Science Ltd. | |
| | 17 | D.E. BLISS, W. WALUKIEWICZ and J.W. AGER, III; E.E. HAILER, K.T. CHAN, S. TANIGAWA, Annealing studies of low-temperature-grown GaAs:Be, J. Appl. Phys. 71 (4), Feb. 15, 1992, pp. 1699-1707, 1992 American Institute of Physics, © 1992 American Institute of Physics | |
| | 18 | JAMES R. CHELIKOWSKY and MARVIN L. COHEN, Nonlocal pseudopotential calculations for the electronic structure of eleven diamond and zinc-blende semiconductors, Physical Review B, July 15, 1976, pp. 556-582, Volume 14, Number 2, | |
| | 19 | S.R. WHITE and L.J. SHAM, Electronic Properties of Flat-Band Semiconductor Heterostructures, Physical Review Letters, Sept. 21, 1981, pp. 879-882, Volume 47, Number 12, 1981 The American Physical Society, © 1981 The American Physical Society | |
| | 20 | T. OBATA, S. FUKUSHIMA, T. ARAYA, N. OTSUKA, Photoluminescence of nearly stoichiometric LT-GaAs and LT-GaAs/AlAs MQW, Journal of Crystal Growth 227-228 (2001), pp. 112-116, © 2001 Elsevier Science B.V. | |

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| | 21 | JUN-YUAN CHEN, JENN-GEE LO and LUKE SU LU, Optical Transitions via the Structure-Defect Levels Due to Lattice Vacancies in InSb, Japanese Journal of Applied Physics, June 1991, pp. 1169-1175, Vol. 30, No. 6 | |
| | 22 | U. SIEGNER, M. HAIML, F. MORIER-GENOUD, R.C. LUTZ, P. SPECHT, E.R. WEBER, U. KELLER, Femtosecond nonlinear optics of low-temperature grown semiconductors, Physica B 273-274, 1999, pp. 733-736, © 1999 Elsevier Science B.V. | |
| | 23 | M.R. MELLOCH, J.M. WOODALL, and E.S. HARMON, Low-Temperature Grown III-V Materials, Annu. Rev. Mater. Sci., 1995, 25: 547-600, 1995 by Annual Reviews Inc. | |
| | 24 | DIETRICH MARCUSE and TIEN-PEI LEE, On Approximate Analytical Solutions of Rate Equations for Studying Transient Spectra of Injection Lasers, IEEE Journal of Quantum Electronics, Sep. 1983, pp. 1397-1406, Vol. QE-19, No. 9, © 1983 IEEE | |
| | 25 | G.A. BARAFF and M.A. SCHLUTER, Electronic aspects of the optical-absorption spectrum of the EL 2 defect GaAs, Physical Review B, Apr. 15, 1992-I, pp. 8300-8309, Volume 45, Number 15, © 1992 The American Physical Society | |
| | 26 | JEROME FAIST, FEDERICO CAPASO, DEBORAH L. SIVCO, CARLO SIRTORI, ALBERT L. HUTCHINSON; ALFRED Y. CHO, Quantum Cascade Laser, Science, New Series, Apr. 22, 1994, pp. 553-556, Volume 264, Issue 5158, © 1994 American Association for the Advancement of | |
| | 27 | JEROME FAIST, FEDERICO CAPASSO, CARLO SIRTORI, DEBBIE SIVCO, ALBERT L. HUTCHINSON, SUNG-NEE G. CHU and ALFRED Y. CHO, Mid-infrared field-tunable intersubband electroluminescence at room temperature by photon-assisted tunneling in couple-quantum wells, Appl. Phys. Lett. 64 (9), Feb. 28, 1994, pp. 1144-1146, © 1994 American Institute of Physics | |
| | 28 | B. GRANDIDIER, HUAJIÉ CHEN, and R.M. FEENSTRA; D.T. McINTURFF; P.W. JUODAWLKIS and S.E. RALPH, Scanning tunneling microscopy and spectroscopy of arsenic antisites in low temperature grown InGaAs, Applied Physics Letters, Mar. 8, 1999, pp. 1439-1441, Volume 74, Number 10, © 1999 American Institute of Physics | |
| | 29 | R.M. FEENSTRA, J.M. WOODALL and G.D. PETIT, Observation of Bulk Defects by Scanning Tunneling Microscopy and Spectroscopy: Arsenic Antisite Defects in GaAs, Aug. 23, 1993, pp. 1176-1179, Volume 71, Number 8, © 1993 The American Physical Society | |
| | 30 | R.M. FEENSTRA, Cross-sectional scanning tunnelling microscopy of III-V semiconductor structures, Semicond. Sci. Technol. 9, 1994, pp. 2157-2168, © 1994 IOP Publishing Ltd. (Printed in UK) | |

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| | 31 | G.M. MARTIN, Optical assesment of the main electron trap in bulk semi-insulating GaAs, Appl. Phys. Lett 39(9), Nov. 1, 1981, pp. 747-748, © 1981 American Institute of Physics | |
| | 32 | R. ERRIQUE VITURRO, MICHAEL R. MELLOCH, JERRY M. WOODALL, Optical emission properties of semi-insulating GaAs grown at low temperatures by molecular beam epitaxy, Appl Phys. Lett. 60(24), June 15, 1992, pp. 3007-3009, © 1992 Aerican Institttue of Physics | |
| | 33 | A. BALDERESCHI, NUNZIO O. LIPARI, Spherical Model of Shallow Acceptor States in Semiconductors, Physical Review B, Sept. 15, 1973, pp. 2697-2709, Volume 8, Number 6 | |
| | 34 | A. CHANTRE, G. VINCENT, D. BOIS, Deep-level optical spectroscopy in GaAs, Physical Review B, May 15, 1981, pp. 5335-5359, Volume 23, Number 10, © 1981 The American Physical Society | |
| | 35 | PETER C. SERCEL and KERRY J. VAHALA, Analytical formalism for determining quantum-wire and quantum-dot band structure in the multiband envelope-function approximation, Physical Review B, Aug. 15, 1990-II, pp. 3690-3710, Volume 42, Number 6, © 1990 the American Physical Society | |
| | 36 | G. LUCOVSKY, On The Photoionization of Deep Impurity Centers in Semiconductors, Solid state Communications, 1965, pp. 229-302, Vol. 3, Pergamon Press Ltd. (Printed in Great Britain) | |
| | 37 | P. SILVERBERG, P. OMILING, and L. SAMUELSON, Hole photoionization cross sections of EL2 in GaAs, Appl. Phys. Lett. 52 (20), May 16, 1988, pp. 1689-1691, © 1988 American Institute of Physics | |
| | 38 | EVAN O. KANE, Band Structure of Indium Antimonide, J. Phys. Chem. Solids., Vol. 1, pp. 249-261, Pergamon Press 1957 | |
| | 39 | M. JAROS, Wave functions and optical cross sections associated with deep centers in semiconductors, Physical Review B, Oct. 15, 1977, pp. 3694-3706, Volume 16, Number 8 | |
| | 40 | G.A. BARAFF, Stress splitting of the EL2 zero-phonon line: Need for reinterpretation of the main optical transition, Physical Review B, May 15, 1990-I, pp. 9850-9859, Volume 41, Number 14, © 1990 The American Physical Society | |

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| | 41 | SOKRATES T. PANTELIDES, The electronic structure of impurities and other point defects in semiconductors, Reviews of Modern Physics, Oct. 1978, pp. 797-858, Vol. 50, No. 4, © 1978 American Physical Society | |
| | 42 | T.C.L.G. SOLLNER, E.R. BROWN, W.D. GOODHUE, and H.Q. Le, Observation of millimeter-wave oscillations from resonant tunneling diodes and some theoretical considerations of ultimate frequency limits, Appl. Phys. Lett. 50(6), Feb. 9, 1987, pp. 332-334, © 1987 American Institute of Physics | |
| | 43 | S. AHMED, M.R. MELLOCH, E.S. HARMON, D.T. McINTURFF, and J.M. WOODALL, Use of nonstoichiometry to form GaAs tunnel junctions, Appl. Phys. Lett. 71 (25), Dec. 22, 1997, pp. 3667-3669, © 1997 American Institute of Physics | |
| | 44 | E.R. BROWN, C.D. PARKER and T.C.L.G. Sollner, Effect of quasibound-state lifetime on the oscillation power of resonant tunneling diodes, Appl. Phys. Lett. 54 (10), Mar. 6, 1989, pp. 934-936, © 1989 American Institute of Physics | |
| | 45 | G. BREMOND, G. GUILLOT et A. NOUAILHAT, Spectres de sections efficaces absolues de photo-ionisation des ions de transition 3d dans Inp, Revue Phys. Appl. 22 (1987), pp. 873-879 | |
| | 46 | M.R. MELLOCH, D.D. NOLTE, J.M. WOODALL, J.C.P. CHANG, D.B. Janes, and E.S. HARMON, Molecular Beam Epitaxy of Nonstoichiometric Semiconductors and Multiphase Material Systems, Critical Reviews in Solid State and Materials Sciences, 21(3) (1996), pp. 189-263, © 1996 by CRC Press, Inc. | |
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